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STAFFING AND MANNING A LARGE DATA PROCESSING INSTALLATION.(U)
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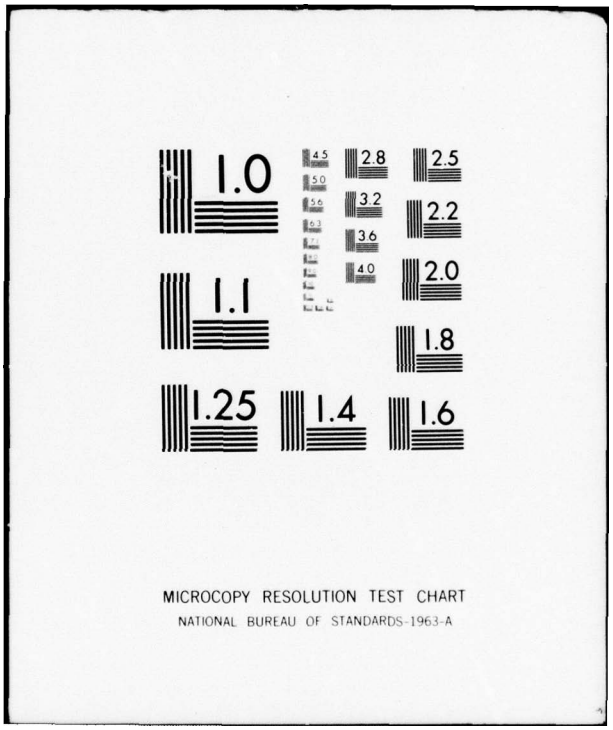
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27 August 1976

STAFFING AND MANNING A LARGE DATA PROCESSING INSTALLATION

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Manning Guides for Data Automation: Administrative Management Functions; Programmer and Analyst Functions: Computer Operations; Data Entry Functions; Product Support Functions; Tape and Disk Pack Library Functions; Data Preparation and Control Functions; Production Control and Scheduling.

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

Manning Guides and standards, to be realistic and effective, must be developed from hard-core workload factors with units of measure that are factual, relative, and will result in a reasonable requirement for people to staff an applicable function. To be acceptable to management for the manning standards must satisfy not only todays operating requirements, but likewise provide for the capability of forecasting realistic requirements into the foreseeable future.

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Of foremost concern to the DPI manager is the prime function of Equipment and Administrative Management. These functions basically consist of Utility Software management, Applications Software Techniques management, Training, Technical Support Planning and Analysis, and Plans and Programs administration. Herein lies the strong right arm of DPI management, and therefore, of necessity, must be adequately staffed and manned.

Probably second in the line of importance to a DPI manager is the Data Systems Development and Maintenance function. Qualitative and quantitative considerations are of equal concern. Past experience and the manager's best judgement are prime factors for determining manning requirements in this area.

Falling in line then, for the complete DPI staffing, are the Computer Operations and Operations Support areas. Adequate Standards and Guides are available for computing equitable manning and staffing requirements in these areas. Just make certain that the measures and factors used are relative and compatible with the workload. The Manning Guide must provide for flexible staffing, remain fluid, and always be relatable to change.

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Data Automation Branch

Sacramento Air Logistics Center/ACD

McClellan Air Force Base, California 95652

FOREWARD

This study project was instituted at the request of Mr. Ward Winkler, Deputy Chief, Data Automation Branch. The study charter was to validate, and/or determine the adequacy of, Manning Guides & Standards used by the Air Force Logistics Command for establishing manpower requirements to staff the Data Processing Installations at it's five Air Logistics Centers. The results of this study, conclusions and recommendations, make up the text of paper.

Recognition must be given to Mr. Winkler for his administrative and professional guidance, and to W. Pope, Z. Wiley, D. Murphy, J. Chandler, R. Torres, A. Jessee, and F. Williams for their technical assistance in developing the baseline, rationale, and statistical data used in this study.

APPROVED:

RICHARD A. THAYER, Col., USAF

Chief, Data Automation Branch

ABSTRACT

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INTRODUCTION

The present manpower guides and standards, being applied for establishing manpower requirements to staff a Data Processing Installation, in many areas are considered to be unrealistic. For this reason a comprehensive in-depth study was undertaken as an effort to develop acceptable methods for workload measurements, factors and standards that will equate definitized workloads to realistic manpower requirements.

The functional areas addressed in the study were those areas considered by the author to be the more critical and vulnerable functions of a Data Processing Installation (DPI). There was no attempt in this study to define, or isolate for review, individual positions within a DPI. The concern is scoped within the major functions only of a DPI.

An organizational structure will appear to surface within the study, but it is not the intent to treat it as such. Here again, it is the function and not the organization that is being addressed. However, organization size and complexity does come into play when consideration is given to numbers of administrative management and supervisory personnel required.

There are many ramifications and variables to be considered when looking at the many diversified workloads which cross all functional areas within the Data Automation Activity. To be objective and realistic these variables were considered, but were generally placed into two workload categories, fixed/static or variable/fluctuating. These are controlled by either fixed constants, or by a variable constant applied to the selected units of workload volume or factor.

Each functional area basically stands on its own as you will see in the text of the report. Every effort was made to stay within the bounds of DoD, Air Force, and the Air Force Logistics Command policies as established in current directives, regulations, and manuals. The Techniques employed included historical experience, statistical, and administrative judgement. General measurement procedures used included workload sampling, manhour accounting by work unit, engineered standards, statistical standards, and operational audits.

The study was started under the pretense that: within the Air Force many of todays published manning guides and manpower standards were either outdated or totally unrealistic; workload factors were not truly related to the functions; workload units were not properly incremented for accurate measurement; valid statistical data not considered for use;

terms for equating workload to functions were ill defined; the results, therefore, were unrealistic and the requirements unacceptable.

The study thus assumed the following objectives: align guides and standards to todays operating environment; relate workload factors to the real-world function; establish equitable units of measure which relate to definitized workloads; provide standard equations which equate workloads to function and result in realistic manpower requirements.

MANAGEMENT FUNCTION

EQUIPMENT AND ADMINISTRATIVE MANAGEMENT

Work Center Responsibilities -

1. Utility Software Management
2. Applications Software Techniques Management
3. Training for all skill requirements
4. EDPE Technical Support Planning and Analysis
5. Plans and Programs Administration

The workloads in the Management Section can be said to fall into two functional categories. One category covering all functions directly related to the EDP equipment, and the other category to those administrative and management functions unrelated to equipment. Using a manning guide based solely on equipment or "Equipment Points" as the workload measure to compute manpower requirements to support the equipment related management functions (Items 1, 2, 3, 4 above) can be considered adequate and realistic, but should be restricted to these functional areas. Equipment Points are defined as points received for equipment on-board adjusted for gains and losses of units in a subsequent 12 month period, where XT is total points, and X1, X2, X3, and X4, is large, medium, small scale computers, and PCAM plus remote equipment respectively. Scale of computers is determined by range of purchase price (New) as follows:

Large - $1,500,001 and up

Medium - $ 250,001 to $1,500,000

Small - $ 1 to $ 250,000

XT then is equal to $1.0X_1 + .37X_2 + .29X_3 + .01X_4$

As an example, assume an installation with 6 large, 5 medium, 2 small scale computers, and 167 pieces of PCAM and remote equipment. The total equipment points would be (6 X 1.0) + (5 X .37) + (2 X .29) + (167 X .01) or 10.10. An engineered staffing standard (developed by the Air Force Logistics Command using an operational audit) of 264.996, when multiplied by the equipment points, gives you the total manhours required per month to support the equipment management function. The total manhour requirement, when divided by an availability manhour factor of 144 hours per month, equates to the Manpower Requirement. In this example, 10.10 X 264.996 = 2676.4596 manhours. This divided by 144 = 18.58 or 19 manpower spaces as the requirement.

Many of the functions within this work center are completely unrelated to equipment management, and therefore, the manpower requirements should be computed on the basis of a related "work-generator" type workload factor. A standard manning equation and workload factor was developed by using the methods of work sampling, operational audit and time

accounting. At the Sacramento Air Logistics Center, when this data was accumulated and equated to an average monthly workload factor, we arrived at a manhour constant of 1173.0. This constant, of course, will vary by installation depending on the type and number of related work center duties, and the volume of workload involved. This constant, which is actual manhours, when divided by the manhour availability factor of 144 hours, will equate to the manpower requirement. In this instance, the requirement would be 8 manpower spaces.

Supervisory staffing of the Management Function, and it's normal Unit staff offices, is not included in the above computed requirements. The rationale being that these staff offices cross and support all functional areas within the section and certain collateral responsibilities for workloads in other sections of the Data Automation activity. Therefore, this manning realistically should be established on a one-for-one position basis. A typical staffing might be as follows:

Office	Supervisory	Steno/Clerk Typist
Section Office	1	1
Unit Staff #1	1	1
Unit Staff #2	1	2
Totals	3	4

Using the manhour availability factor of 144 hours, the staff total requirement equates to a standard manning equation constant of 1008.0.

By applying the foregoing, and using the cited examples, the manpower requirements computation would be as follows:

Manning Equation -

Where "Y" = Total Manhours: $Y = 1173.0 + 1008.0 + 264.966XT$

Where XT = Total Equipment Points: $XT = 10.10$

Computation: $1173.0 + 1008.0 + (264.966 \times 10.10) = 4857.1566$

Requirement: $4857\text{-}1566 \div 144 = 33.73$ or 34

It might be noted that the function of managing and supporting the operating and utility software programs area was not addressed separately in this paper, though it is an area of prime concern to all Air Logistics Center (ALC) Data Automation managers. Under the equipment point system the computer software support, provided for most of the installed hardware systems, may be considered adequate, however, you must consider software of the magnitude and complexity as that required for the Center's CDC CYBER 70 systems. Therefore, any support for a 3rd generation advanced computer hardware system possibly should be considered over and above the manpower requirement computed using the manning guide.

Third generation software system programs differ from those of prior equipment in three major areas. These are the size and complexity of the software programs, the overall workload management problems encountered with large multiprogramming systems and the unique aspects of this hardware configuration. These characteristics must be locally controlled and supported. They are the same functions present in previous software systems but never to the depth and complexity of a CYBER 70, or equivalent, system.

An operating system consisting of over 200 programs requiring nearly 2 full reels of computer tape to hold the assembler level source code cannot be left to absentee management or user guidance. This operating system and a highly complex utility system with functions such as those of FORM, UPDATE, Record Manager, and INTERCOM all controlled by a very general purpose job control language are several orders of magnitude beyond the complexity of any previous commonly used Command software system.

The problems of workload scheduling for large multiprogramming systems have never been solved in the official workload control system, nor have they been studied to any depth across the Command. There is no effective usage recording capability or guidance for consistent reporting for local system management. Performance evaluation and

estimates of available local capacity are the responsibility of the software support groups. The selection of appropriate system options for the local workload mix, establishment of effective system development/management standards, and the recording and reporting of usage statistics are all unresolved management problems which depend on the software support organization. The CYBER equipment configuration installed at the Air Logistics Centers is unprecedented for the applications we support. The problems of effective data storage and retrieval, file structure and data administration using large-volume random devices have never been encountered for multiple batch/file oriented systems. Many problems of system design using these capabilities are outside of the Center's operating experience.

The ALC software support groups are looked to for guidance and training in these and other areas. Manning standards based on equipment points do not recognize these situations or make allowance for them. This condition coupled with the instability which is common to relatively new software put to unusual use by unfamiliar users renders the current manning standards unrealistic. It all boils down to technical knowledge and experience coupled with the judgement of management.

DATA SYSTEMS DESIGN/MAINTENANCE

FUNCTIONS OF THE PROGRAMMER/ANALYST

Work Center Responsibilities -

1. Develop, modify, program and code Data Systems for which the Air Logistics Center has Command development and maintenance responsibility. Referred to as Pilot Systems.

2. Develop and implement one-time or local additives to assigned data systems.

3. Research and resolve systems problems.

4. Prepare for and implement new data systems.

5. Provide required user/customer support.

6. Perform overall data systems management functions.

7. Make feasibility studies and provide systems support on all engineering, scientific, and technical workloads.

For the past several years the Air Force Logistics Command has applied a manning guide which uses the number of pilot development systems as the workload measure to determine programmer/analyst manpower requirements at their Air Logistics Centers. A manhour constant of 11832.310 has been used as the standard for management of non-pilot systems. The standard equation; where "Y" = Total Man-hours, and "X" = Number of Pilot Systems, Y = 11832.310 + 387.694X. Translated, this equates to 82.2 people for management of non-pilot systems and 2.7 people for each

pilot system. To assume that all Air Logistics Centers require the same number of people to maintain surveillance over their operational systems, and to assume that all pilot systems are of the same size and complexity has no basis in fact. It is therefore believed that the use of "pilot systems" as the workload factor is invalid and will not project an acceptable or realistic requirement. It is suggested that functions in these work centers be treated as three separate workload categories; Pilot Systems Development, Pilot Systems Maintenance, and Operational Systems Surveillance. The following manpower requirements computation methods are offered as a possible solution to the problem.

1. Pilot Systems Development:

For Pilot systems development the manning requirements should be computed and justified using the "Manpower Package" concept by applying the criteria and formulas contained in AFM 25-5. The workload factor for Pilot systems used in the present standard is far from being adequate for new systems development (Equates to 2.7 manpower spaces per pilot system). Several published papers suggest guidelines for arriving at a quantitative estimate of manpower resources. These papers conclude that the quantitative method of estimating, as presented, is only a guideline and not a precise method, in fact, it is not as good as an estimate

based on sound experience. All of this correlates with the guidelines established for developing a "Manpower Package", including a quantitative formula for selecting the standard equation factor used in the computation. AFM 25-5, chapter 1, par. 1-8, provides for three methods to compute manpower requirements, i.e., Engineered Standards, Statistical Standards, or Manpower Guides. A mixed application of these standards is permissible and feasible. The use of Manpower Guides permits staff judgement/estimates which must be applied when developing manpower requirements for new systems development workloads, i.e., "Manpower Packages".

Programmer/Analyst functions considered in a "Manpower Package" are; Developing System Requirements Definition, Designing a System, Developing a Preliminary Design, Developing a Detailed Design, Performing Programming Functions, Conduct a Final Evaluation of the System, and Operations Support of the System. The package is developed and requirements justified using workload frequency and work unit time data which are derived from an operational audit based on historical experience and best judgement techniques.

For a new development effort the manpower estimating technique must always consider the complexity level of the system. In determining the level of complexity, factors to be considered should include; total number and type of input and output files; type and number of calculations to be

performed; amount and type of test data; number of system interfaces; and testing required. The complexity level will determine the lines of code per man-hour which can be anticipated. Based on information contained in references (1) below, and our past experience, the complexity factors would be as follows: Easy - 3; Average - 2; Difficult - .9. You must now determine the number of lines of code required to satisfy the requirement, which seems to be the logical unit of measure.

Where: Z = total man-hours;

X = number of lines of code;

Y = complexity factor.

Then Z = X ÷ Y.

The man-hour availability factor of 144 hours per person per month will be used to determine the man-months worth of work to be accomplished. For example, assume a system with 6800 lines of code and a complexity factor of .9: Z = 6800 ÷ .9, or 7556 man-hours; 7556 ÷ 144 = 52.47 man-months of work; on 4.37 personnel equivalents for one year. Assuming a 10% overhead factor, for clerical and administration support, equates the total project manning requirement to 5 people.

(1) Brandon, Dick H. & Max Gray, Project Control Standards, Auerbach; Baker, F. F., "Management of Production Programming", IBM Systems Journal, Vol. II, No. 1, 1972; Shell, R. L., "A Work Measurement System for Computer Programming", University of Illinois, 1970.

2. Pilot Systems Maintenance:

The requirements for this workload should be computed separately from systems development, and a workload factor, with it's related manhour constant, distinct from the factor applied to normal operational data systems surveillance. To assume that the same number of people are required for pilot systems maintenance as for day-to-day surveillance of operational systems has no basis in fact. Maintenance of pilot systems goes beyond just surveillance, e.g., system program logic modifications, directed block-changes, program enhancements, etc. The computation method, which is likewise true for operational systems surveillance, and the workload factors used, conform to guidance outlined in AFM 25-5, as well as measures and equations found in AFLCM 26-3.

A case in point which must be recognized is that often times an operational pilot system requires a complete or major redesign, which, in essence would return the system workload to a development status. If the system falls in the category of being large/complex it may be necessary to initiate a "Manpower Package" to substantiate a one-time additive authorization required to accomplish the task.

For a like situation for an average less complex system a "Manpower Package" will normally not be required, or

justified, but instead would be accomplished within current authorizations on a loan/borrow basis.

3. Operational Systems Surveillance:

The programmer/analyst requirements for this workload should be calculated by applying factors derived from definitized tasks required in day-to-day operational data systems surveillance. Based on a study of the many involved tasks, as outlined below, the associated manhours were equated to a constant for use in the standard equation which, when related to the most common workload factor of "Number of User Products Produced and Managed", results in a realistic and acceptable manpower requirement.

The workload factor (number of products) was arrived at by considering all user products, equated to a monthly equivalent, based on the frequency of the product. For example; a weekly product equates to a monthly equivalent of 4.35 products per month, a bi-weekly product to 2.16, etc. This factor is deemed to be the most equitable and auditable measure for this workload and the data is reportable in some form of mechanized media.

Surveillance Task List:

1. Typical Daily Functions: % = 20

   a. Check previous Days agendas to insure correct and complete processing.

b. Verify product distribution and notify user of any problems or delays.

c. Review inputs and daily agendas for accuracy.

d. Coordinate adjustments to scheduled computer time if necessary.

e. Maintain and monitor the "Data Management" (DATA-MAN) file.

2. Customer Support Functions: % = 50

a. Accomplish special one-time products for mission essential requirements.

b. Daily communication with customer on status of user products, i.e., change to number of copies, distribution, etc.

c. Coordinate all system revisions, additions, or deletions with customer.

d. Schedule and monitor as required reports.

e. Write programs for local system additives.

3. System Programs Control: % = 15

a. Make system program patches received either by phone or letter from pilot activity.

b. Advise pilot activity on problems encountered with system revision or program patches.

c. Evaluate proposed or suggested system changed.

4. Special and Periodic Functions: % = 15

a. Special studies and periodic management reports.

b. Train newly assigned personnel.

c. Serve as backup in system areas when assigned programmer or analyst is absent.

d. TDY on major system revisions.

e. Provide mission customer system orientation and indoctrination.

f. Prepare and give briefings to visiting personnel.

The manhour factors for each of the above tasks, respectively, are as follows: (1) = .11082; (2) = .27705; (3) = .083115; (4) = .083115. These factors add up to a total Manhour Equation Constant of .5541.

(See next page for sample computation.)

MANPOWER COMPUTATION

SYSTEMS MAINTENANCE AND SURVEILLANCE

Workload Factors -

Administrative: Each section assumed to be staffed with a Chief and one Clerk/Steno. Each Unit to be staffed with a Supervisor and one Clerk/Typist.

Let "A" = Number of Sections

Let "B" = Number of Units

Let X_1 = Number of Pilot System Runs

Let X_2 = Number of User Products Produced

Where "Y" = Total Manhours

$Y = (A \times 288.0) + (14.385X_1) + (.5541X_2) + (B \times 288.0)$

Manhour Availability Factor = 144

Work Load Definition -

X_1: Total number of computer runs in the Pilot Systems, excluding standard utility programs.

X_2: Total number of User Products produced from all data systems.

Source: Systems Documentation Charts in AFLC 171 Series Manuals.

Sample Computation:

$Y = 576.0 + 2304.0 + 10414.74 + 15119.726$

$Y = 28414.466$

Requirement: $\frac{28414.466}{144} = 198$

COMPUTER OPERATIONS

FUNCTIONS OF COMPUTER OPERATORS

Work Center Responsibilities -

1. Load Computer Systems
2. Operate Computer Console and Associated Components
3. Monitor Operating System
4. Unload Computer Systems

It is generally agreed that the present Command standards and guides used to establish manpower requirements in the Computer Operations Units are acceptable. The guide adequately provides for multi-shift manning and a realistic adjustment to manning when more than one like-type computers are co-located. However, consideration must likewise be given to the shift supervisor requirements when various type computers are co-located in a single unified machine room facility. For example, within a common machine room your may have installed multiple computer systems operating conceptually in a like mode and therefore could be considered, for supervisory shift staffing and management purposes, as a homogenius operating unit.

A situation which exists at the Sacramento Air Logistics Center, and very likely at the other Air Logistics Centers, is the physical location and operation of the UNIVAC 1050II computer. The present manpower guide provides for a shift supervisor, and an operations supervisor when operating ten

or more shifts. The guide should recognize that with the location of the U1050II within an existing machine room facility, or adjacent machine room, which is already staffed with adequate shift supervision, there is no requirement for additional supervisory manning. It is our experience that the one operator per shift is adequate.

Multiple shift manning and staffing has always been of concern to an operations manager, and often is quite problematic. The unavoidable circumstance of a seven day, round-the-clock operation is shift overlapping. There are proponents of four ten-hour days, as well as three days of twelve hours each (plus 4 hours to make a 40 hour week), which in essence would eliminate shift overlaps. Theoretically, it could be possible to operate the same number of computers for the same periods of time, as most centers do today, with an "X" % reduction in manpower. The next few pages are examples of computer operations standard manpower tables.

STANDARD MANPOWER TABLE			WORK CENTER TITLE/CODE: B3500 Operations					
AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MANHOUR AVAL	WORKLOAD VALUES					
			CONSTANT MANNING COMPUTER SHIFTS					
		144 GRADE	5	10	15	18	21	* 21
			MANPOWER REQUIREMENT					
**								
Comp Sys Ops Off	5155	CIV	1	1	1	1	1	1
Shift Supervisor	5155	CIV	1	2	3	4	5	5
Comp Cons OPr (116)	51192	CIV	1	2	3	4	5	10
Comp Ops Supv	51170	CIV	1	2	3	5	5	10
Computer Operator	51150A	CIV	2	4	5	5	6	12
TOTAL			6	11	15	19	22	38

** DISK MANAGER

*USE THIS COLUMN WHEN AN ADDITIONAL COMPUTER CO-LOCATED.

AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MANHOUR AVAL	WORKLOAD VALUES					
		GRADE	MANPOWER REQUIREMENT					

STANDARD MANPOWER TABLE			WORK CENTER TITLE/CODE: 360/65 Operations					
AIR FORCE SPECIALTY TITLE (AFS)	AFSC	AUTHORIZED/AVAL GRADE	WORKLOAD VALUES: CONSTANT MANNING					EACH ADDL COMP #21
			COMPUTER SHIFTS					
			5	10	15	18	21	
			MANPOWER REQUIREMENT					
Shift Superisor(326)	5155	CIV	1	2	3	4	5	5
Comp Cons Opr (116)	51192	CIV	1	2	3	4	5	10
Comp Ops Supv	51170	CIV	1	2	3	4	5	8
Computer Operator	51150C	CIV	1	2	3	4	5	7
TOTAL			4	8	12	16	20	30

*USE THIS COLUMN WHEN AN ADDITIONAL COMPUTER IS CO-LOCATED.

AIR FORCE SPECIALTY TITLE (AFS)	AFSC	AUTHORIZED/AVAL GRADE	WORKLOAD VALUES					
			MANPOWER REQUIREMENT					

STANDARD MANPOWER TABLE			WORK CENTER TITLE/CODE: 300/40 Operations					
AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MINIMUM AVAIL	WORKLOAD VALUES					
			CONSTANT MANNING COMPUTER SHIFTS					
		144	5	10	15	18	21	
		GRADE	MANPOWER REQUIREMENT					
Shift Supervisor (326)	5156	CIV	1	2	3	4	5	
Comp Cons Opr (116)	51102	CIV	1	2	3	4	5	
Comp Ops Supv	51170	CIV	1	2	3	4	5	
Computer Operator	51150C	CIV	1	2	3	4	5	
TOTAL			4	8	12	16	20	

AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MINIMUM AVAIL	WORKLOAD VALUES					
		GRADE	MANPOWER REQUIREMENT					

STANDARD MANPOWER TABLE			WORK CENTER TITLE/CODE: CYBER Operations					
AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MANHOUR AVAL	WORKLOAD VALUES					
			COMPUTED SHIFTS - CONSTANT MANLOAD					
		144	5	10	15	18	20	
		GRADE	MANPOWER REQUIREMENT					
Shift Supervisor (326)	5155	CIV	1	2	3	4	5	
Comp Cons OPR (116)	51192	CIV	1	2	3	4	5	
Comp Ops Supv	51170	CIV	1	2	3	4	5	
Computer Operator	51150	CIV	1	2	3	4	5	
TOTAL			4	8	12	16	20	
AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MANHOUR AVAL	WORKLOAD VALUES					
		GRADE	MANPOWER REQUIREMENT					

STANDARD MANPOWER TABLE			WORK CENTER TITLE/CODE: 7080 Operations					
AIR FORCE SPECIALTY TITLE (AFS)	AFSC	AVAIL GRADE	WORKLOAD VALUES: COMPUTER SHIFTS Constant Manning					EACH ADDTL COMP
			5	10	15	18	21	21
		GRADE	MANPOWER REQUIREMENT					
(326) Shift Supervisor	5155	CIV	1	2	3	4	5	5
Comp Cons Opr (116)	51102	CIV	1	2	3	4	5	10
Comp Ops Supv	51170	CIV	1	2	3	4	5	8
Computer Operator	51150C	CIV	1	2	3	4	5	7
TOTAL			4	8	12	16	20	30

*USE THIS COLUMN WHEN AN ADDITIONAL COMPUTER IS CO-LOCATED.

AIR FORCE SPECIALTY TITLE (AFS)	AFSC	AVAIL GRADE	WORKLOAD VALUES					
		GRADE	MANPOWER REQUIREMENT					

STANDARD MANPOWER TABLE			WORK CENTER TITLE/CODE: 1401 Operations					
		MAXIMUM AVAL	WORKLOAD VALUES					
AIR FORCE SPECIALTY TITLE (AFS)	AFSC			CONSTANT MANNING				EACH ADD'L COMP.
				COMPUTER SHIFTS				
		144	5	10	15	18	21	* 21
		GRADE	MANPOWER REQUIREMENT					
Computer Operator	513.5C0	CIV	1	2	3	4	5	10

* USE THIS COLUMN WHEN AN ADDITIONAL COMPUTER IS CO-LOCATED.

AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MAXIMUM AVAL	WORKLOAD VALUES					
		GRADE	MANPOWER REQUIREMENT					

STANDARD MANPOWER TABLE			WORK CENTER 301	TITLE/CODE OPERATIONS					
AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MANHOUR AVAIL	WORKLOAD VALUES					EACH ADDTL COMP 301	
			301 COMPUTER SITES						
			CONSTANT MANNING						
			5	10	15	18	21	* 21	
		GRADE	MANPOWER REQUIREMENT						
Comp Cons Opr (116)	51192	CIV	1	2	3	4	5	7	
Comp Ops Supv	51170	CIV	1	2	3	4	4	7	
TOTAL			2	4	6	8	9	14	

*USE THIS COLUMN WHEN AN ADDITIONAL COMPUTER IS CO-LOCATED.

AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MANHOUR AVAIL	WORKLOAD VALUES						
		GRADE	MANPOWER REQUIREMENT						

STANDARD MANPOWER TABLE			WORK CENTER TITLE/CODE: UJ050 IT Ops				
AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MANHOUR AVAL	WORKLOAD VALUES				
			COMPUTER SHIFTS - Constant Manning				
		144	5	10	15	20	21
		GRADE	MANPOWER REQUIREMENT				
(326) Shift Supervisor	51192	CIV	1	1	1	1	1
Comp Ops Supv	51170	CIV		1	2	2	2
Computer Operator	51150	CIV	1	1	2	3	4
Computer Operator	51130	CIV	1	2	2	3	3
TOTAL			3	5	7	9	10

AIR FORCE SPECIALTY TITLE (AFS)	AFSC	MANHOUR AVAL	WORKLOAD VALUES				
		GRADE	MANPOWER REQUIREMENT				

DATA ENTRY FUNCTION

CARD PUNCH AND VERIFICATION OPERATORS

Work Center Responsibilities -

1. Keypunch Set-Up: Perform all operations prepatory to actual machine operation.
2. Punch data in tabulating cards from source documents.
3. Verifier Set-Up: Perform all operations prepatory to actual machine operation.
4. Verify and correct punched tabulating cards from source documents.

The present standard manning equation uses a constant factor of .006434 hours per card punched and/or verified. Assuming a static workforce at an acceptable level of competence the standard appears to provide for adequate manning. However, because of the excessive rate of turn-over experienced by most Air Logistics Centers (as high as 138% in a 12 month period) an agency overhire authorization should be considered to compensate for the turn-over and permit a continuous hire and training program. This can be accomplished by either increasing the standard equation constant to .007721, or by granting an overhire authorization of a minimum 20% above the computed requirement.

The high rate of turnover is probably caused by the very basic nature of the work itself. This coupled with the normal low clerical rate of pay, and the probability of multiple rotating shifts, does create a problem for management in maintaining a

static and competent workforce.

A keypunch unit operating on a 3 shift/5 day week basis would normally require a unit supervisor and three shift supervisors. Where the workload justifies additional shifts a proportionate number of supervisors should be considered.

Using a 3 shift/5 day week operation, the standard manning equation would be as follows:

Constant for Supervision = 576.0

Constant for Measuring Workload = .006434

Where Y = "Total Man-hours" and X = "Average Volume of Cards Punched and Verified", Y = 576.00 + .006434X.

Man-hour Availability Factor = 144

A Sample Computation where X = 500,000:

Y = 576.0 + (.006434 X 500,000) = 3793.0

3793.0 ÷ 144 = 26.34 or 27 Personnel Equivalents.

Assuming the overhire authorization factor of 20% to be valid, the figure of 26.34 would be increased by 5.26, making the total requirement 31.60, or 32 personnel equivalents.

The work measurement constant of .006434, which equates to 155.42 cards punched or verified per hour, has proven to be realistic.

The Sacramento Air Logistics Center has not had any experience to date on Key-to-Disk equipment, and therefore comments or suggested manpower standards are not offered in this paper.

MATERIAL CONTROL AND DISTRIBUTION

INPUT/OUTPUT, PRODUCT SUPPORT FUNCTION

Work Center Responsibilities -

1. Input Processing: Accomplish collecting, control, and distribution of all input documents.
2. Product Finishing: Provide product finishing service by decollating, bursting, drilling, booking, and binding form paper products.
3. Distribution and Product Mailing: Deliver finished products to systems users. Package, label, and address outgoing magnetic tapes, punched cards, paper and microform products for mailing.

The staffing provided by the present guide is totally inadequate. This manning guide also uses the computer inventory as the workload measure. The computer inventory has no relation to the number of input documents handled or the number of products requiring bursting, decollating, booking, binding, distribution control (pickup and delivery), and filing of 9's agenda; nor the Warehouseman, Supervisory or Clerk-Typist functions. A more realistic and acceptable measure of workload in the area of Input Control is the average monthly volume of input documents handled. Source of data is the logs maintained in the Product Support Unit and schedules from the Dataman system.

APPENDEX V

The most acceptable and realistic measure, for the function of Output Products processing, is paper usage and number of products processed on a monthly average basis. Source for paper usage is the stock records, and the number of products processed is available through the Dataman system.

Further, it is logical to separate the requirements for the Warehousemen (Supply Standard applicable), and Clerk-Typist, both of which are required on a 1 shift - 8 hours - 5 day week basis. The Supervisory requirments are based on 21 shifts per week. To be realistic these requirements must be established on a one-for-one basis as follows:

Unit Supervisor	1
Shift Supervisors	3
Clerk-Typist	1
Warehousemen	2

This total requirement is equated to a fixed constant of 1008.0 in the formula for the standard equation.

Standard Manning Equation

Y = Total Manhours

X_1 = Input Workload Measure (Document Volume Processed)

X_2 = Product Decollating Workload Measure (Boxes of Paper)

X_3 = Bursting, Booking, Binding, and Distribution Workload Measure (Output Volume)

Constant of 1008.0 = Fixed/Static Manhour Factor

Where $Y = 1008.0 + .0008X_1 + .250X_2 + .1479X_3$

$Y = 1008.0 + 1573.333 + 450.0 + 4022.88$

Requirement: $\frac{7054.213}{144} = 49$

NOTE: The constants of .0008, .250, and .1479 are measures of work units per hour. These were arrived at through an operational audit and related time accounting.

TAPE LIBRARY SUPPORT FUNCTION

Work Center Responsibilities -

Provide Tape Library support to Computer Operations: secure tapes for production jobs; blank tapes from release list; file and index tapes; degauss tapes; maintain number assignment register; perform tape problem research; package tapes for off-base shipping; store incoming tapes; maintain an alternate tape storage area; test and rehab damaged tape.

The problem with the present manning guide is also the use of the computer inventory as the measure of workload. As Data systems are transferred to larger scale computers, thus capacity replacing other computers and reducing the inventory, the tape handling and control requirement does not diminish, yet our manpower authorizations would be reduced. It is suggested that the workload measure be changed to number of tapes handled for a far more adequate and realistic measure of the requirement. Likewise, consideration should be given to the number of removable/replaceable Disk Packs handled (pulled, filed, indexed) in the library function. This will become more important in the future as additional applications are implemented on large scale Mass Storage/Disk File oriented systems. At the present time this workload is minimal and is not included in our computation. Stated below is our experience to date as related to the duties of disk pack monitors.

DUTIES OF DISK PACK MONITOR

	DESCRIPTION	TIME EXPENDED	FREQUENCY
1.	Arrange for disk surface analysis when necessary.	:05 per pack	As Required
2.	Prepare a Disk Surface Analysis Report.	:03 per pack	As Required
3.	Prepare a card deck to reformat.	:10 per pack	As Required
4.	Maintain history, surface analysis, and format listing files.	:03 per pack	As Required
5.	Assign disk pack and update inventory card file and list.	:05 per pack	As Required
6.	Release disk pack and update inventory card file and list.	:03 per pack	As Required
7.	Verify weekly P040 Dataman inventory list vs card file.	:15 per week	Weekly
8.	Monthly physical inventory.	1:00 per month	Monthly
	Average weekly manhours	3:00 per week	Weekly
	Additional time required only on incoming or outgoing disk shipments:		
	Inspection of incoming disk packs	:15 per pack	As Required
	Preparation of outgoing disk packs	:15 per pack	As Required

The results of a detailed study conducted to determine valid work measurements of library functions are as follows:

Functions	Findings
Pull tapes for Set Up	Avg. 35 min. per 100 tapes Avg. 3059 tapes per day
Blank tapes from release list	Avg. 1 hr. per 100 tapes Avg. 1505 tapes per day
File & Index Tapes	Avg. 41 min. per 100 tapes Avg. 4564 tapes per day

Tape problem research/testing/rehab and processing interface and redundant storage tapes requires an average of 12 hours per day.

Data required for average number of tapes handled is obtainable from the DATAMAN system.

COMPUTATION OF TAPE LIBRARIAN REQUIREMENTS

X_1 = Factor for Pulling tapes for set up (Nr. of TAPES)

X_1 = 0.583 Hrs. per 100 Tapes

X_2 = Factor for Blanking Tape release list (Nr. of TAPES)

X_2 = 1.0 Hrs. per 100 Tapes

X_3 = Factor for Filing and Indexing Tapes (Nr. of TAPES)

X_3 = 0.683 Hrs. per 100 Tapes

Factor for tape problem research/testing/rehab, and processing interface and redundant storage tapes is a constant of 261. (AVG of 12 HRS per day, 5 days per wk, 4.35 wks per mo.).

Equation Formula:

$261 + (0.583 \times (X_1)) + (1.0 \times (X_2)) + (0.683 \times (X_3))$

Sample Computation:

$261 + 535.019 + 451.500 + 935.163 = 2182.682$

$\frac{2182.682}{144} = 15.1575$ or 16 = RQMT

NOTE: In the advent of adding disk pack workload to this standard equation an X_4 factor of "XXX" should be inserted in the formula. The equation constants were developed through an operational audit and related time accounting.

DATA CONTROL

Work Center Responsibilities -

Control of Input and Output:

Accomplish collecting, control, and packaging of input and output for assigned data systems. Preparation of production packages to include consolidation and/or preparation of run sheets, tape labels, utilization cards, control cards, system name or date cards, and card input.

The major problem with this manning guide is likewise the use of the computer inventory as the workload unit of measure. The transition of systems to larger capacity and faster computers in no way lessens the volume of input data handled, or the number of production packages prepared, yet the present manning guide reduces our manpower requirement/ authorization as the computer inventory is reduced. It is suggested that the workload unit of measure be the number of production packages prepared and the equation factor of .6964X be used (hours required per workload unit).

Workload Factor -

X = Work Units Processed (Production Packages)

Standard Manning Equation -

Y = Total Manhours

Y = .6964X

Workload Factor Definition -

X: A two digit code used to identify job packages prepared and processed on ADPE.

Source: Manual count required and internal records maintained. Data can be reported in a mechanized system.

Sample Computation: X = 4463

Y = .6964 X 4463 Y = 3108.0332

RQMT: 3108.0332 ÷ 144 = 22

PRODUCTION CONTROL AND SCHEDULING

Work Center Responsibilities -

1. Production Analysis: Perform detailed analysis of production work flow, internal control procedures and methods of management for operational data systems. Maintain surveillance over equipment utilization, analyze problems and make changes in schedules and assignments to accommodate overloads, priorities and eliminate backlogs.

a. Job Staging: Secure the necessary tapes and instructions for a scheduled job, post reel numbers and counts, verify the raw data count of the processing instruction worksheets, initial worksheets with operator number and date and forward to Data Control. Insure value cards are available, stamp worksneet, check mechanized production packages to insure that library copy has been pulled and sent to the library for the required tapes to be pulled. Review and verify the card to tape reels being recycled. Review the entire package for completeness and assurance that the required posting has been made; insure that date cards and utiilization cards are in proper sequence; place worksheets, reels, labels, run cards, and value cards in appropriate area for computer processing; post all reels going forward into other systems on appropriate worksheets; verify and initial worksheets

against typewriter documentation; check operator decisions made during running of system, verifying positive and negative inputs/outputs. Check various conditions and values in system name cards. Receive completed worksheets and output products and complete utilization cards and production package.

2. EDPE Scheduling: Develop plans and schedules for processing data systems. Review and finalize 30-day projections; prepare daily and/or weekly detailed operating schedule, review previous day's schedule for uncompleted jobs in process to update current schedule; determine priorities of jobs to be scheduled; make detailed schedule, mechanically list schedule and make distribution to appropriate work center.

Here again, the Command Manning Guide uses computer equivalents as the workload factor. The Standard Equation (Manhours) used is as follows:

Where "Y" = Total Manhours, $Y = 148.0X_T$

Where "X_T" = Total Computer Equivalents, X_1 = Number of Large Scale Computers, X_2 = Number of Medium and Small Scale computers. The point value for $X_1 = 1.0$, $X_2 = .8$. The Manhour Availability Factor of 144 hours per month is used, as in all other manpower computations. This standard, as of this publication, appears to be adequate to support this function at the Air Logistics Centers. However, with the

advent of Third Generation Computers replacing several smaller capacity computers, there may be indicated a reduced manning requirement of some degree. Yet, the workload would remain relatively constant and therefore a look at a more realistic measure of the workload should be taken.

It is suggested that a more reasonable workload factor, for the Job Staging function, might be the number of production packages handled and processed. For the Scheduling function, it is suggested that the more reasonable workload factor might be the number of separate Jobs processed on a given computer. A word of advice is to stay loose, take a look at the present situation, and if the situation dictates, or is altered in time, apply either the presently used manning guide or consider use of the suggested approach.

CONCLUSION

You can't beat historical experience, and the Manager's best judgement! Don't fight it - You might like it!

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